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THE EXTRAORDINARY SUNSETS.

By A. C. Ranyard.

THE last number of KNOWLEDGE contains an extract from a letter received from a resident at Graaff Reinet, in South Africa, mentioning that a brilliant glow in the sky after sunset had for a month past attracted the attention of the inhabitants. Similar letters have been received from places in the northern hemisphere as distant as Ceylon on the one hand and Trinidad on the other; and within the last month sunset and sunrise tints of more than usual splendour have been observed in England and over the continent of Europe.

Professor Piazzi Smyth has endeavoured to account for the sunset and sunrise phenomena observed in India, by supposing that there must have been an unusual amount of aqueous vapour in the higher atmosphere, due to exceptional meteorological conditions such as precede a great fall of rain. But similar meteorological conditions seldom exist over so wide an area as that embraced between the Cape, India, and the West Indian Islands, and exceptional meteorological conditions seldom remain with comparatively little change for more than two months. I am rather inclined to attribute to a cosmical origin the glorious phenomena which have been observed over a whole hemisphere, and possibly all round the globe. Before explaining my theory, I will give a short *résumé* of the phenonema observed, with some of the observations I have collected on the subject.

Dr. J. Arnold, writing to the *Times* of October 9, makes the following quotation from the letter of a friend in the Island of Trinidad:—"Last Sunday (September 2), about five o'clock, the sun looked like a blue globe . . . . and after dark we thought that there was a fire in the town, from the bright redness of the heavens." Mr. Arnold adds, "All my correspondents agree as to the blue colour of the sun." Three days afterwards a cyclone swept over Martinique.

In *Nature* of Oct. 11 a letter is printed from Mr. W. R. Manley, dated Ongole, India, Sept. 14, in which he says:—"My attention was first called to the matter on Sept. 10. On looking out I saw that the sun, which was somewhat dimmed by a haze, had a decidedly greenish-blue tinge. The same thing was observed on the 11th and 12th, both morning and evening; but my observations were confined to the evenings. About four o'clock (at least I did not notice it earlier) an indistinct bluish tinge appeared in the light. This gradually passed into a greenish colour, and this in turn became tinged with yellow as the sun approached the horizon. After the sun was down, light yellow orange and red appeared in the west, a very deep red remaining for more than an hour after sunset; whereas under ordinary conditions, all traces of colour leave the sky in this latitude within half-an-hour after the sun disappears. On the evening of the 13th the sun appeared to be perfectly clear, but after it was below the horizon the western sky became brilliantly illuminated with yellow orange and red in the order I have mentioned. These sank one after the other, leaving at last an arc of brilliant red along the west, the inner portion of the segment contained by the arc being composed of orange. This disappeared in turn, and the whole western sky became yellow again without any distinct outlines, and this gradually deepened into red, which remained for an hour or more after sunset. The latter phenomenon was not unlike an ordinary sunset, except in brightness and duration . . . . there was apparently nothing unusual in the state of the weather at the time."

Since the beginning of September, numerous communications have been received from all parts of India giving accounts of the remarkable sunset tints, and for the last two months similar sunsets have been observed in Europe.* A friend, writing to me from Nice on Nov. 15, says:—"We have had extraordinarily beautiful sunsets for the last month, with a coloured twilight lasting much longer than usual." The prolonged afterglow has been noticed in England. Captain Noble, in the last number of KNOWLEDGE, says that on Nov. 8 "the whole of the western sky was ablaze with the most vivid crimson glow; albeit, the sun had set for an hour and a half;" and Mr. W. T. Lynn, formerly of the Greenwich Observatory, informs me that there is a very striking increase in the duration of the morning as well of the evening twilight. It is therefore evident that there must be finely-divided particles of matter suspended at a considerably greater height than usual in the atmosphere; and the question arises, Is this matter condensed aqueous vapour? Is it volcanic dust from the great eruption of Krakatoa in the Malay Archipelago, which occurred at the end of August? Or does the dust come from outer space?

As to the first hypothesis. The meteorological conditions at the earth's surface have not been strikingly uniform over the area within which the remarkable sunsets have been observed; and there has been no widespread and exceptionally great downpour of rain such as might have been expected if the amount of aqueous vapour in the atmosphere over a whole hemisphere of the earth had been much larger than usual.

The date of the great eruption of Krakatoa, as compared with the date of the earliest observations of the green sun in India, would seem at first sight to favour the hypothesis that the colours must be due to light dispersed by volcanic ashes or volcanic dust borne away by the trade winds.

Those who have watched an eruption of Etna or Vesuvius know how the volcanic vapours are carried to a certain altitude above the crater, where they spread out in a horizontal cloud, which, under ordinary circumstances, does not attain a very great altitude. It is possible to conceive that such a cloud laden with dust might, in the

* I have searched a file of American newspapers, and the pages of *Science*, a periodical published at Boston, but have not succeeded in finding any reference to red sunsets in America. I should be glad to know whether they have been seen in the United States and China.

neighbourhood of the equator, be carried upward by the heated air which gives rise to the trade winds. But in the northern hemisphere the trade winds blow in a north-easterly direction, and this theory will not account for the carriage of dust to India, which lies to the north-west of Java; or to South Africa, which lies in a south-westerly direction. The fine dust of the Sahara, carried upward by exceptionally strong sirocco winds, occasionally reaches Rome and Florence, but all traces of it are lost as far north as Paris and London. It seems, therefore, very improbable that terrestrial dust should be carried upward by the wind and distributed over a whole hemisphere. It may be suggested that dust was on this occasion projected by the volcanic forces to a far greater altitude than the altitude reached by the dust from the Sahara. But dust projected with great velocity would be rapidly stopped by the resistance of the atmosphere, and would not, unless borne away by the wind, be carried as far as stones and large masses of scoriæ. It will hardly be suggested that the volcanic cloud over Krakatoa was carried upwards by the heat of the eruption, and spread outwards over a whole hemisphere, drifting against the prevailing winds to India and South Africa. But the volcanic theory is completely negatived by the observation of the blue sun setting in the fiery heavens as seen from Trinidad (near to the centre of the opposite hemisphere from the Krakatoa eruption) on the 2nd of September, for it cannot be supposed that the volcanic matter was carried half round the earth in the period of seven days which elapsed between Sunday, the 26th of August, when the Java eruption began, and Sunday the 2nd of September, when the blue sun was seen setting at Trinidad.

There remains the not improbable supposition that the earth has encountered a cloud of dust in space. In a paper published in the *Monthly Notices* for January, 1879, I have collected a series of observations which show that meteoric dust is continually being deposited on the earth's surface.

To account for the simultaneous phenomena observed in India and the West Indian islands, it is necessary to suppose that just before Sept. 2 the earth passed through a region of space more than ordinarily rich in the dust which we know is so widely distributed in space.

If the dust-laden region was so large that the earth occupied many hours in passing through it, we may expect to find that the phenomena caused by the presence of dust in the higher atmosphere have been observed over more than a hemisphere of the earth's surface. We may also learn something as to the time which small particles of dust occupy in sinking to the earth from the higher regions of the atmosphere, where they are first brought to rest. Possibly months, or even years, may be occupied by the finer particles in the process of sinking to the ground, for small particles of dust are probably carried upwards by convection currents in the daytime and sink again during the night. Prof. C. A. Young has shown that threads from a gossamer spider, attached to a stick, float upwards when exposed to the sun, while they sink when the stick is removed into the shade. Such small bodies, when exposed to the sun, seem to be involved in a film of heated air, which is sufficient to raise them, and will even raise the body of the gossamer spider as well as his web in the summer air.

It is well known that a fall of snow brings down quantities of meteoric particles, and it will be a matter of interest to observe whether the first fall of snow greatly affects the red sunset phenomena. Judging from the duration of the after-glow, it seems probable that much of the dust may still be above the region of cloud formation.* No doubt the larger particles fell in the first few weeks, for the blue appearance of the sun when near the horizon, as seen through the clear air of the tropics, has passed away. I imagine that the whole of the phenomena observed may be accounted for by the mere presence in the upper atmosphere of a larger amount of dust than is ordinarily suspended there. It is known that water in which fine dust is suspended assumes a beautiful blue colour, and small particles suspended in the air probably produce a similar effect. We are perfectly familiar with the blue colour of the dispersed light from the heavens, and if the amount of dispersed light were greatly increased, it is only to be expected that the colour of the dispersed light would sensibly affect the colour of the more intense transmitted light.

The green colour afterwards seen when the sun was close to the horizon is, of course, easily accounted for by a combination of the ordinary absorption of the blue end of the spectrum with the absorption of the red end producing the blue colour, so that only the green or middle part of the spectrum was left. The red and orange tints of the after glow would be caused in the same manner as the ordinary sunset tints, only being exaggerated by the longer course of the rays through the atmosphere.

THE CHEMISTRY OF COOKERY.

By W. Mattieu Williams.

XXIV.

SINCE the publication of my last paper, I have learned the proper name of the Swiss compound there described as *fondevin*, according to my recollection of its pronunciation in Switzerland. In an old edition of Mrs. Rundell's "Domestic Cookery," it is described as "*fondu*." A similar dish is described in that useful book "Cre-Fydd's Family Fare," under the name of "*Cheese Soufflé* or *Fondu*." I had looked for it in more pretentious works, especially in the most pretentious and the most disappointing one I have yet been tempted to purchase, viz., the 27th edition of Francatelli's "Modern Cook," a work which I cannot recommend to anybody who has less than £20,000 a year and a corresponding luxury of liver.

Amidst all the culinary monstrosities of these "high-class" manuals, I fail to find anything concerning the cookery of cheese that is worth the attention of my readers. Francatelli has, under the name of "Eggs à la Swisse," a sort of *fondu*, but decidedly inferior to the common *fondu* of the humble Swiss osteria, as he lays the eggs upon slices of cheese, and prescribes especially that the yolks shall not be broken; omits the milk, but substitutes (for high-class extravagance' sake, I suppose) "a gill of double cream," to be poured over the top. Thus the cheese is not intermingled with the egg, lest it should spoil the appearance of the unbroken yolks, its casein is made leathery instead of being dissolved, and the substitution of six-penny worth of double cream for a halfpenny worth of milk supplies the high-class victim with fivepence half-penny worth of biliary derangement.

In Gouffe's "Royal Cookery Book" (the *Household Edition* of which contains a great deal that is really useful to an English housewife) I find a better recipe under the name of "*Cheese soufflés*." He says: "Put 2½ oz. of flour in a stewpan, with 1½ pint of milk; season with salt and

* The sediment from water derived from the first fall of snow which occurs this year should be examined, to see whether it is particularly rich in particles of meteoric iron.

pepper; stew over the fire till boiling, and should there be any lumps, strain the *soufflé* paste through a tammy cloth; add 7 oz. of grated Parmesan cheese, and 7 yolks of eggs; whip the whites till they are firm, and add them to the mixture; fill some paper cases with it, and bake in the oven for fifteen minutes."

Cre-Fydd says:—"Grate six ounces of rich cheese (Parmesan is the best); put it into an enamelled saucepan, with a teaspoonful of flour of mustard, a saltspoonful of white pepper, a grain of cayenne, the sixth part of a nutmeg, grated, two ounces of butter, two tablespoonfuls of baked flour, and a gill of new milk; stir it over slow fire till it becomes like smooth, thick cream (but it must not boil); add the well-beaten yolks of six eggs, beat for ten minutes, then add the whites of the eggs beaten to a stiff froth; put the mixture into a tin or a cardboard mould, and bake in a quick oven for twenty minutes. Serve immediately."

Here is a true cookery of cheese by solution, and the result is an excellent dish. But there is some unnecessary complication and kitchen pedantry involved. The following is my own simplified recipe:—

Take ¼ lb. of grated cheese; add it to a gill of milk in which is dissolved as much powdered *bicarbonate of potash* as will stand upon a threepenny piece; mustard, pepper, &c., as prescribed above by Cre-Fydd.* Heat this carefully until the cheese is completely dissolved. Then beat up three eggs, yolk and whites together, and add them to this solution of cheese, stirring the whole. Now take a shallow metal or earthenware dish or tray that will bear heating; put a little butter on this, and heat the butter till it frizzles. Then pour the mixture into this, and bake or fry it until it is nearly solidified.

A cheaper dish may be made by increasing the proportion of cheese—say, six to eight ounces to three eggs, or only one egg to ¼ lb. of cheese for a hard-working man with powerful digestion.

The chief difficulty in preparing this dish conveniently is that of obtaining suitable vessels for the final frying or baking, as each portion should be poured into, and fried or baked in, a separate dish, so that each may, as in Switzerland, have his own *fondu* complete, and eat it from the dish as it comes from the fire. As demand creates supply, our ironmongers, &c., will soon learn to meet this demand if it arises. I am about writing to Messrs. Griffiths & Browett, of Birmingham, large manufacturers of what is technically called "hollow ware"—*i.e.*, vessels of all kinds knocked up from a single piece of metal without any soldering, and have little doubt that they will speedily produce suitable *fondu* dishes according to my specification, and supply them to the shopkeepers.

The bicarbonate of potash is an original novelty that will possibly alarm some of my non-chemical readers. I advocate its use for two reasons. First, it effects a better solution of the casein by neutralising the free lactic acid that inevitably exists in milk supplied to towns, and any free acid that may remain in the cheese. At a farm-house where the milk is just drawn from the cow it is unnecessary for this purpose, as such new milk is itself slightly alkaline. My second reason is physiological, and of greater weight. Salts of potash are necessary constituents of human food. They exist in all kinds of wholesome vegetables and fruits, and in the juices of *fresh* meat, but *they are wanting in cheese*, having, on account of their great solubility, been left behind in the whey.

This absence of potash appears to me to be the one serious objection to the free use of cheese diet. The Swiss peasant escapes the mischief by his abundant salads, which eaten raw contain all their potash salts, instead of leaving the greater part in the saucepan, as do cabbages, &c., when cooked in boiling water. In Norway, where salads are scarce, the bonder and his housemen have at times suffered greatly from scurvy, especially in the far North, and would be severely victimised but for special remedies that they use (the mottebeer, cranberry, &c., grown and preserved especially for the purpose. The Laplanders make a broth of scurvy-grass and similar herbs). Mr. Lang attributes their recent immunity from scurvy, which was once a sore plague among them, to the introduction of the potato.

Scurvy on board ship results from eating salt meat, the potash of which has escaped by exosmosis into the brine or pickle. The sailor now escapes it by drinking citrate of potash in the form of lime juice, and by alternating salt junk with rations of tinned meats.

I once lived for six days on bread and cheese only, tasting no other food. I had, in company with C. M. Clayton, son of the Senator of Delaware, who negotiated the Clayton-Bulwer Treaty) taken a passage from Malta to Athens in a little schooner, and expecting a three days' journey we took no other rations than a lump of Cheshire cheese and a supply of bread. Bad weather doubled the expected length of our journey.

We were both young, and proud of our hardihood in bearing privations, were staunch disciples of Diogenes; but on the last day we succumbed, and bartered the remainder of our bread and cheese for some of the boiled horse-beans and cabbage-broth of the forecastle. The cheese, highly relished at first, had become positively nauseous, and our craving for the vegetable broth was absurd, considering the full view we had of its constituents, and of the dirtiness of its cooks.

I attribute this to the lack of potash salts in the cheese and bread. It was similar to the craving for common salt by cattle that lack necessary chlorides in their food. I am satisfied that cheese can never take the place in an economic dietary, otherwise justified by its nutritious composition, unless this deficiency of potash is somehow supplied. My device of using it with milk as a solvent supplies it in a simple and natural manner.

* Before the Adulteration Act was passed, mustard flour was usually mixed with well-dried wheaten flour, whereby the redundant oil was absorbed, and the mixture was a dry powder. Now it is different, being pure powdered mustard seed, and usually rather damp. It not only lies closer, but is much stronger. Therefore, in following any recipe of old cookery-books, only about half the stated quantity should be used.

THE SENSES IN INFANTS.

(*Continued from page* 315.)

WHEN we come to consider the development in infants of touch and sight, we are surprised to find, that authorities are much divided in their estimate both of the tactile sensibility and the powers of vision displayed by the new-born infant.

Now, in dealing with these divergent opinions, it is obvious that we may either pit the various psychologists against each other, and elect to put faith in some rather than in others on grounds of general knowledge of their scientific reliability, accuracy, and so forth, or we may assume that the discrepancies in recorded results are due to great individual differences in infants, and proceed, therefore, to impartially enumerate all the conflicting statements. This last course being the more scientific, is the one we shall adopt.

XUM

We will begin with touch.

Dr. Kussmaul and others hold that from the very beginning touch is a finely-developed sense, and Mr. Sully goes so far as to hazard the suggestion that even taste is at first scarcely differentiated from it. Professor Preyer, however, maintains that at birth there is such a low degree of skin susceptibility, that the nose, hands, and lips of the new-born infant may be pricked with impunity—the child neither starting, nor betraying any other sign of discomfort.

The Professor did not himself try this experiment, nor would we counsel our readers to do so; but he claims to have arrived by other roads at the same conclusion, one of his proofs being that the infant does not blink when the water of its bath splashes into its eyes.

Without expressing any opinion as to the soundness of the professor's deductions, we will content ourselves with saying, that every one—Professor Preyer included—agrees that within three days of birth the child's skin susceptibility is very great, particularly for those tactile sensations which are most closely connected with sensations of temperature, and which are involved in the contact of the child with its nurse's or mother's body. Grimaces and movement moreover testify to the fact that the sensation of tickling is soon felt in full intensity under the appropriate stimulus. Darwin, when one of his children was seven days old, tickled the naked sole of its foot with a piece of paper, whereupon the child jerked its foot away and curled its toes as older children do when tickled. Perez again noticed that in the very youngest children disagreeable tactile sensations would call forth grimaces. Altogether, then, we may consider there is fair ground for saying that touch is not one of the tardily developed senses.

Far otherwise, however, is it with sight. If we are to believe some of the statements made on the subject, this sense requires for its development twenty or thirty days.

At birth, of course, no child sees,—so far all authorities concur. But, while Dr. Kussmaul and Professor Preyer declare that a child cannot fix an object—that is, cannot "bring the eye into such a position that the image of the object may fall upon the point of most distinct vision in the centre of the retina"—before it is three weeks old; and Perez and others, going further, say not before the end of the fourth week,—Darwin, on the other hand, declares that his child's eyes were fixed on a candle as early as the ninth day, and Mr. Sully asserts, in reference to the infant Clifford, that on the second day "the previously futile attempts to bring the two eyes into harmonious action were crowned with a measure of success, and they were observed to converge for an instant on the father's face if held invitingly near. By the fourth day the command of the eye was far greater, and it was possible to notice the effect of an object in attracting the organ in a particular direction, if not too far from that of the point previously looked at."

Equally great difference of opinion prevails with regard to the act of turning the head towards the light. G. H. Lewis affirms that it takes several days before the child makes any movement of the head towards the light, and Prof. Preyer sets the limit at six days; but Dr. Kussmaul states that he saw one child perform this act on the second day, and his observation is borne out by the testimony of the philosopher Tiedemann, who, a hundred years ago, noted that his infant son sought the light from the very beginning. It is perhaps only just to mention that Tiedmann's son grew up later into as eminent a man as his father, and it may, therefore, well be urged that he was what nurses call a forward child, and no criterion for others. But making due allowance for this, we have still before us evidence of a very conflicting kind.

This much, at least, is clear, that it usually requires between two and three weeks for the sense of sight to come into full operation, and that its gradual development takes place somewhat in this wise.

From the very first there is a slight but appreciable susceptibility for sensations of light, as is proved by the two facts, that the pupil of the babe's eye contracts under the influence of strong light, and that in some instances sleeping infants, when two or three days old, have been made to screw up their eyes, start, and wake, when a candle has been brought near their closed lids. Now, this sensibility of the eye to light induces vague spasmodic movement on the part of that organ, and out of these movements the fixing of the eye upon objects gets gradually developed. The eyes of the new-born child move quite independently of each other, the one going to the left, the other to the right, and one sometimes moving alone, but little by little symmetrical action is evolved. The following a moving object with the eye is a later acquisition, and the colour sense is also somewhat in abeyance. It is an open question what colours children are most attracted by; some prefer yellow, some red, but there is no doubt that they are all repelled by black. The power of accurately discriminating red, green, yellow, and blue is not manifested, Professor Preyer says, before the beginning of the child's third year.

The moving object attracts the child's attention more quickly than the stationary one, even though the latter chance to be brightly coloured. The more complex sensations of sight—the sensations of form, apparent size, distance, volume, and position are all late manifestations, for the child of ten or eleven months will stretch out its arms and try to grasp the moon; and will even in its third year make futile efforts to thrust large playthings into small boxes.

When we pass from sight to hearing, we find almost perfect agreement amongst psychologists. The infant, as we have had occasion to say before, is born perfectly deaf, but within three days of birth becomes so sensitive to sound, that any sudden noise will make it start and blink its eyes. In the child Clifford a distinct movement of the head in response to sound was observed on the second day. Darwin tells us that in the case of his child, sounds made it start and wink its eyes much more frequently than did sight. But he goes on to add, "Although so sensitive to sound in a general way, he was not able, even when 124 days old, easily to recognise whence a sound proceeded, so as to direct his eye to the source." Children are very early pleasantly excited by music or singing, Tiedemann's son showing the greatest liveliness and joy when, forty days after birth, he heard the piano played for the first time. Perez points out that clear, tinkling sounds, especially when repeated rhythmically, never fail to give pleasure. Discordant, shrill, deafening noises, however, when once they cease to alarm by their newness, do not seem to offend the infant's ears, as they do those of the adult—a truth to which all can testify who have had much to do with healthy young children, and have learnt by rather disagreeable experience that "everything does for them to make a noise with."

A. M. H. B.

The Largest Locomotive in the World.—This is now being constructed in the Sacramento carriage-building shops of the Central Pacific Railway. It will weigh 73 tons, and have five pairs of driving-wheels. The tender will weigh 25 tons, and the total length of engine and tender will be 65 feet.

SUBMARINE CABLES.

THE facts that the sum of £12,545,000 has been invested in the one French and seven English cables providing telegraphic communication between Europe and North America, that the majority of this investment came from the British public, and that the present market value is only (approximately) £7,000,000, give evidence, were evidence wanting, of the interest that is felt by the speculating and moneyed public in oceanic telegraphy. Apart, however, from a shareholder's point of view, the interest evinced by the "general" public from the time that the first Transatlantic Cable was laid, and for his share in which operation Mr. C. Bright received the honour of knighthood, down to the present moment, is a keen one. Nor is this interest confined to the cables above-mentioned. Events of the past few years have progressed at so rapid a rate, changes in political geography have been so extensively and unexpectedly made, that the saying that "upon the feeble strands of copper connecting the various quarters of the globe depends the fate of empires," is not altogether without a warrant. It would be an interesting calculation to sum up the grand total of the telegraph systems throughout the world, more especially as only a few days since the fiftieth anniversary of the erection of the first telegraph line was celebrated in Germany. Equally interesting, too, would be a study of the improvements that have been made year by year, and almost month by month, in the development of the various systems in vogue. In the case of submarine telegraphy, much has been learned, but most probably much more remains to be learned. The average life of a cable is very short, and is affected by a multitude of causes. The connection between the electrician, the geographer, the physicist, and the naturalist in cable-laying and repairing is so close that anything bearing on the subject is sure to receive ready and careful attention. It is therefore not impossible that the meeting of the Society of Telegraph Engineers, held on the 29th ult., will form one of the landmarks in the history of industrial science. A lengthy discussion resulted from a short paper, contributed by Captain S. Trott and Mr. F. A. Hamilton, in which the authors took up a most daring amd startling standpoint. In effect they endeavoured to demonstrate that in one of the most important details of cable manufacture we were utterly at fault, that not only were we failing to do that which is right, but that we were absolutely doing our best to insure the inefficiency of the cable. This opinion from one who has probably had more practical experience in repairing deep sea cables than any other living man, demands the most serious consideration. It is no wonder then that several gentlemen, many of whom could record considerable experience in cable laying, were placed upon their mettle, and entered into the discussion with the greatest interest.

As our readers are probably aware, the general method adopted in the manufacture of a cable is to enclose the copper conductor in one or more coatings of gutta-percha, or other insulating material, to surround this with a layer of tarred hemp, and to envelop the whole in a heavy iron armour composed of stranded stout iron wire.

The principal accidents to which these cables are liable may be briefly enumerated (say the authors) as follows:—Abrasion by ice and on rocky and stony bottom; ruptures caused by vessels' anchors; injuries inflicted by marine insects; *and the wringing asunder of the core by the iron wires.*

Accidents arising from the first cause have not been numerous; indeed, taking into consideration the heavy masses of ice that beset the coasts and banks of Newfoundland and Cape Breton Island, and extend far west along the shores of Nova Scotia, it is marvellous that so few cases of crushing have occurred.

With regard to breaks on rocky and stony bottom, it is worthy of remark that, excepting in the case of those which have taken place in the immediate vicinity of the shore or in very shallow water, few can be recorded; and we may here state, as the result of long and careful observation, that cables are rarely chafed through, and we believe that injuries attributed to this agency should in some instances be put down to quite another cause.

The number of breaks which have occurred to some cables, in consequence of fishing-vessels hooking them with their anchors, is greatly in excess of those brought about by any other means; but as these accidents are to a great extent unavoidable, and are easily and rapidly repaired, we will dismiss this portion of our subject with the remark, that considering the number of vessels engaged in the great fisheries on the banks lying between the meridian of 48° and 70° West, the wonder is that the cables are not broken far more frequently.

In reference to faults caused by marine insects, it can be said that, although the Atlantic cables have not enjoyed a complete immunity, they have been remarkably free from any very serious attacks of these borers, and, as their assaults can be repelled by well-known means, we do not consider the question a very prominent one, as far as Atlantic cables are concerned.

It is, however, on "the wringing asunder of the core by the iron wires" that the authors have chiefly to speak. Records are very numerous showing that cables have "suddenly snapped without any perceptible cause," and, "with everything favourable, have parted silently and suddenly;" breaks which, according to Dr. Russell, "seemed to point to some mysterious agency existing in the depths of the ocean, beyond the perception of science or man's control." "The agency described as *mysterious* still exists," say the authors, "and the history of some of the most recent Atlantic cables, if published, would prove that these so-called improved types are liable to the same mishaps as those we have mentioned; indeed, they are even more liable, for, notwithstanding their strength, it is quite as difficult, and even more so, to recover them from deep water." The question is asked, "Why do cables suddenly sever in deep water whilst being submerged, or when being picked up, and even after being successfully submerged?' The answer is, that

Iron-armoured cables have a strong tendency to twist or curl, as the spiral *lay* of the wires imparts a constant helical force in a direction contrary to the *lay*.

Consequently, any slack given is apt to result in a kink or a succession of kinks, which is followed by a wringing asunder of the fabric when the strain is renewed. This accounts for most of the misfortunes which have happened in submerging some cables, for whenever it became necessary to stop or slacken speed in shifting from one tank to another, or for some other purpose, the risk of this accident has always been incurred.

An iron-armoured cable cannot be recovered from deep water excepting in short lengths, because the operation of heaving-in causes the armour to unlay or untwist, and this results in an accumulation of turns at and near the ocean bed, and a wringing or wrenching asunder of the fabric is sure to occur.

Cables sometimes break in deep water, because when the iron wires become weakened by corrosion, the curling or untwisting tendency is unopposed, and the stronger portions on either side of the weakened spot untwist, thus exerting a force contrary in direction on each side, but concentrated in action at the damaged portion.

This is the whole secret—this is the mysterious agency, and thus it is that the most serious cause of injury to submarine cables must be attributed to the iron wires.

Further on the authors maintain that gutta-percha is practically indestructible, but iron wire has caused the loss of many miles of submarine cables, and that, excepting when in contact with iron, vegetable fibre is indestructible.

We could (the authors declare) cite numerous instances of cables having been lifted from considerable depths solely by means of the yarn portion of the fabric, which retains its strength sufficiently to bear the superincumbent weight of oxidised iron wires. The core serving, which is composed of common jute yarn, has time after time done duty as the strength-giving material, although

only intended as a padding for the iron armour. The core serving is invariably recovered in a wonderful state of preservation, but the yarns which envelop the iron wires suffer deterioration whenever the latter become oxidised.

The testimony with regard to the enduring qualities of vegetable fibrous material is, in our opinion, so overwhelming, that we are justified in believing it will be readily admitted that a cable constructed without iron wires, and with the strength-giving material composed of hemp, will not possess within itself the elements of decay.

In the opinions of the authors :—

The strength-giving material, by means of which the core can be submerged and recovered, should consist of fibrous yarns or strands made up in such a manner that any twisting or wringing of the fabric is prevented; and, in order to accomplish this, we lay over the insulated conductor a series of spiral or helical servings of non-metallic fibres, yarns, or cords, laid alternately left and right, the fibres, yarns, or cords of each serving being twisted in a direction the reverse of that in which they are wound about the insulated conductor.

This point or feature, although at first sight a trifling consideration, is of the utmost importance, as it constitutes the gist and substance of the principle by means of which any twisting or knuckling of the cable is prevented; for it will be seen that, if the yarns or cords of each serving be similar—that is to say, if they be twisted in the same direction in forming them—the cable will kink, notwithstanding the servings be wound alternately in right and left hand spirals about the core.

A cable such as we have described would not only be more durable than an iron-armoured one, but could be recovered with ease and certainty from any depth.

Strength, lightness, and durability are, we affirm, among the chief requirements in a submarine cable, and these qualifications are to be found in the type which we now submit to the consideration of this Society.

In the discussion that followed the reading of this remarkable paper, the chairman (Mr. Willoughby Smith), who said the company with which he was connected had laid 94,000 miles of cable, of which Mr. Ford had superintended 60,000 miles, maintained the superiority of an iron sheathing, and doubted the possibility of a hemp-sheathed cable enduring the strain.

But the authors, in reply, stated that they had had a cable constructed on their pattern across Halifax harbour for eighteen months, and were in every way pleased with its performance. They said, furthermore, that they had had ample evidence of the wringing action, and in reply to a question put to them by Mr. W. H. Preece, it was stated that the rupture of the cables, when being picked up, invariably took place upon the bottom and at a point where no tension existed, and where no other force could be conceived to exist but the torsion which the authors called "wringing." The production of a piece of rope known to have been submerged in 1801, and only recovered three years since, proved the durability of hemp. It was practically as good as ever, and the only difference apparent was that the major portion of the tar had been squeezed out.

The result of the discussion is yet to be seen; but there is no doubt that it has awakened in the breasts of all interested in the question an intense curiosity, which can only be satisfied by prolonged and careful experiment.

W. Slingo.

NEGLECTED INSECTS.

E. A. Butler, B.A., B.Sc.

BUGS! "Horrid things," you say, no doubt. But stay, my friends, you are thinking only of that disgusting phlebotomist, the bed-bug, the *Acanthia lectularia* of the learned, concerning which there cannot be two opinions. This creature, however, does not really belong to English soil; it is an importation from "foreign parts"; it is, moreover, only one member, and that the most disreputable one, of an extensive group. As it is almost the only representative of that group generally known, we have no other common name for its relations, and so whenever the word is used, it is suggestive only of personal discomfort and foul smells.

I do not know that the matter is much mended if we call the creatures "Hemiptera-Heteroptera," the dissimilar-winged half-wings! This is, too, sesquipedalian, and so bugs I suppose they will have to remain to the end of their days. The creatures are in very many cases beautiful—sometimes exquisitely so; they are frequently grotesque, bizarre, with some parts of their body worked up into the oddest of shapes, as though Nature had experimented with them, and had tried to see how far she could go in altering the form of a member without altogether changing it into something quite different. To all, therefore, who delight in the beautiful or the curious, let me recommend the study of our British bugs, of which we have over 400 kinds.

They are found amongst tall grass, thistles, and nettles, at roots of plants, on the foliage of oak, hazel, and other trees, on furze-bushes and broom, in moss, amongst dead leaves, amongst rubbish at the bottom of haystacks, on the trunks of trees, on palings, in sandy places, under bark, in mud at the bottom of ponds, in ditches and streams, and on the surface of still water. Some of those that live in water are tolerably familiar objects, and are known by such names as Water Boatmen, Water Scorpions, and Water Measurers. A few of the terrestrial kinds sometimes intrude themselves on our notice, appearing in our streets and on our doorsteps, and have received the name of Bishops' Mitres. But the vast majority are scarcely ever noticed by any but those who specially look for them, though they are some of our most abundant insects, are around us everywhere, and may be found with very little trouble.

Excluding for the present the aquatic species, we may say that the greater number readily fall under two heads, which may be conveniently called hard bugs and soft bugs, according as they are encased in a hard, unyielding, horny skin, or have a more delicate and flexible integument. They are normally four-winged insects, though in a large number of cases the wings are more or less imperfectly developed. One great peculiarity of the order is seen in the upper wings, which, instead of being, as in most insects, of uniform texture throughout, appear as if composed of several pieces, like a patchwork quilt. In the hard bugs there are three such pieces, two at the base of the wing, of a somewhat triangular shape, the base of one triangle being placed against one of the sides of the other, and of stout, stiff, horny texture, and one beyond these, thin and flexible, rhomboidal in shape, but with the outer angles rounded. It is this peculiarity of difference in consistency in the different parts of the fore-wing that has suggested both the names Hemiptera (half-wings) and Heteroptera (dissimilar wings). In the soft bugs, in addition to the parts above named, there is a small triangular piece, wedged in, as it were, between the membranous part and one of the basal triangles. This little wedge is sometimes of a much more brilliant colour than the rest of the wing. One occurs to my mind at this moment in which this wedge is of a fiery red, while the greater part of the rest of the insect is deep black. The hind wings are quite plain, and of a very delicate membranous consistency. When the insect is not flying, the hind wings are completely concealed by the other pair, which lie along its back, overlapping one another at their outer extremity, just touching in their middle, and receding from one another towards

their attachment to the body, so as to leave a triangular space, which is occupied by a sort of scutcheon. This latter is often brightly and conspicuously coloured, and is sometimes so large as almost entirely to cover body, wings, and all. The head is very small, but is often borne on enormously broad shoulders—if I may use such a term with reference to an insect. The head carries a pair of jointed appendages which may be likened to strings of exceedingly-attenuated sausages. These go by the name of "antennæ," and in insects generally are composed of a large number of minute joints, but in the present order of a small number of elongated pieces. The middle of the head is prolonged into a kind of snout, from which there proceeds a long-jointed sort of sheath, which, when not in use, is folded back underneath the body, as one might imagine an elephant's trunk might be turned back between its fore-legs. It can be brought out from this position, and stretched in a sloping direction in front of the head. It carries inside four long, sharp-pointed bristles, which can be used to pierce minute holes in the tissues of the animal or plant upon whose juices the creature feeds. The legs of bugs, which are six in number, as usual amongst insects, are long and slender, and forcibly suggest the necessity for much padding if one would produce any semblance of calves.

I am afraid I cannot acquit these insects of the charge of smelling badly. In some of the larger bugs the smell is worse than that of *Acanthia*, and of the same nature. If you are "sweeping" with your net, *i.e.*, passing it backwards and forwards amongst rank herbage, and happen to enclose one, you will probably be informed of its presence by your nose before your eye detects it; but in the majority of our British species the smell is only slight, and frequently almost imperceptible, and in all it passes away with death. Some even exhale a fragrant odour. The smell is produced by a fluid which is excreted from two small openings on the under surface of the body, and is, no doubt, protective in function. Some bugs, especially the soft ones, take very readily to the wing, others never fly at all, but grovel on the ground, roaming about amongst the roots of plants or amongst rubbish, or clinging to the stems and leaves of the plants themselves.

They appear during the summer months, and but few are to be found at other seasons. They pass through a series of changes, after the manner of insects in general. The young bug, when first hatched, is not very unlike the adult in general appearance, though very small and wingless; by a rapid imbibition of nutritious juices, it increases its corporation till the inner man (or rather bug) becomes too great for the outer, when the skin bursts and a new creature emerges, larger and somewhat altered in colour and shape; the same thing goes on again, and is repeated until the final form is reached, each new stage presenting a closer approximation to the appearance of the adult. In the penultimate stage the rudiments of wings put in an appearance, but true wings are never present till the final stage. During all these preliminary transformations, the integument of the insect is soft and yielding, even in the case of those that acquire great hardness when arrived at perfection. The object of this is obvious. It would be fatal for the creatures to be encased in an inflexible armour during the earlier part of their career; there would be no room for expansion, and so no possibility of growth; but when the final stage is reached, there is no such difficulty, for perfect insects do not grow, though they go on eating. The food taken by the perfect bug, no doubt, goes to assist it in its reproductive function, which is really the only business it has to perform when fully grown, and previously to this stage this function has been impossible, as the insect has been sexually immature.

Bugs, then, differ from the majority of insects in not passing through a quiescent stage previous to the assumption of the adult form. Those insects which pass through such a stage, which is familiarly known in the butterflies and moths as the "chrysalis," are in their earliest life totally unlike what they are destined to develop into, and during their quiescent pupahood the vast modifications that have to take place before the creature appears in its adult form, are elaborated out of the store of nutriment laid up in the body during the preliminary stages. Now the bugs are already, at the commencement of their life, so similar in general form to their adult shape that the changes they have to undergo are comparatively trifling, and therefore no quiescent stage seems to be necessary. Bugs live entirely upon juices which they extract from plants or animals. The hard bugs seem to favour an animal and the soft ones a vegetable diet; this, however, must not by any means be taken as a hard and fast rule. Some are attached to special plants, apparently because they either derive their nutriment directly from the plant, or indirectly from other insects that feed upon the same plants.

As a rule, they are not to be regarded as coming under the category of useful insects. When a plant is, so to speak, tapped, and its juices gradually absorbed, it, of course, tends to become weak, shrivelled, stunted, and unhealthy; and, therefore, any creature which feeds on vegetable juices may be reckoned, *à priori*, as likely to become injurious to man, since his welfare so largely depends upon the vegetable produce of the soil. But, in this particular instance, little damage seems to be done, as the plants principally attacked are wild species of no economic importance. There are a few plants which seem specially liable to the attacks of bugs; the different kinds of grasses are much infested, furze and broom have each their special inhabitants, nettles and thistles afford a home and food to large numbers, rest-harrow and heath are much frequented by some species, and amongst trees, oak, hazel, sallow, birch, ash, and fir have each their own peculiar hemipterous fauna. Amongst those which imbibe the stronger aliment, there is one large species that inhabits outhouses, lumber-rooms, &c., and it is sufficiently cannibalistic to prey upon its near relative, the bed-bug. It is popularly called the Fly-bug, and is in its earlier stages much addicted to the curious habit of piling little particles of dust upon its back; these adhering to the hair that cover its body give it a peculiar fluffy appearance.

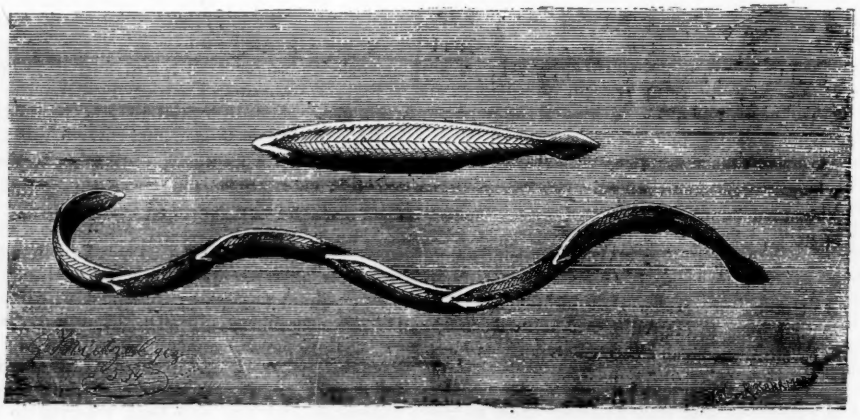
If you would see bugs at home and pry into the secrets of their life, go in July or August to a flourishing bed of nettles or thistles, or to some luxuriant patches of ragwort, sit down beside the plants and carefully look them over, without disturbing them. It will be surprising if you do not see plenty of bugs of a fairly active character engaged in seeking their livelihood or courting their spouses. They will be chiefly green, a favourite colour with *soft* bugs, and may easily be recognised by the characters of wings and beak referred to above, for there are no other insects to which those descriptions apply. If you wish to secure them, a bag of stout calico attached to an iron ring and stuck in a handle should be vigorously and rapidly drawn backwards and forwards across any patch of rank herbage, and in this way with very little trouble large numbers will be obtained. They will generally prove very active in the net, and many will be sure to escape either by flight or by running over the edge of the net; still, a sufficient stock may easily be obtained by a few sweepings, and may be transferred to pill-boxes, in which they will safely travel.

XUM

THE LANCELET FISH.

THE lancelet (*Amphioxus lanceolatus*) has so little similarity to other members of the fish family that for a long time it was undecided whether it belonged to the vertebrate or invertebrate class. Its body is about five centimètres long, slender and angular, symmetrically tapering off to a point at each end. A slender fin extends from the head around the extremity of the tail and terminates at the vent. The mouth, a mere longitudinal fissure, is under the front part of the body, and its orifice is crossed by numerous cirri. This fish has no heart, the place of that organ being taken by tubular vessels having a pulsating motion, which drives the transparent colourless blood into the smaller veins. It has no bones, the muscles being attached to soft cartilage, and the spinal cord is not protected by a bony covering. The body is covered by a delicate skin without scales. It is found in the seas of the torrid and temperate zones. It lives in the sand, in which it buries itself, and being so nearly the colour of the sand, it is completely concealed, and is often only perceived when the sand is washed through a fine meshed sieve. Probably, wherever it makes its appearance it is far more abundant than is generally supposed. If it is necessary for it to leave the sand, it swims through the water with a gliding, serpent-like motion, and with the quickness of an arrow, but in a short time it embeds itself again in the sand. Mr. Couch was the first captor of this fish on the British coast, and found his first specimen in the sand about fifty feet from the receding tide. He says that when swimming the head can hardly be distinguished from the tail.

Mr. Wilde put one of these fish in a tumbler of water. "It moved round the glass like an eel, and, although no eyes were perceptible, it avoided the finger or any substance put in its way, stopping suddenly or turning aside from it." The mouth is surrounded by cilia, the motion of which causes the passage of water for food and for breathing.



The Lancelet Fish.

These fish have a peculiar and remarkable power of attaching themselves to each other, sometimes clustering together, sometimes forming a string from fifteen to twenty centimètres long. In the latter case they swim in unison, with a serpent-like motion. When swimming in a line they adhere to each other by their flat sides, the head of one coming up about one-third on the body of the one before it, as seen in the engraving.—From *Brehm's Animal Life.*

THE STAR-NOSED MOLE.*

THE star-nosed mole is strictly an American animal, and its genus is confined to America alone. Its great peculiarity lies in the strange formation of its nose—or, rather, its nasal appendages. The muzzle, which is a kind of cartilaginous disc, sending out about twenty fibres or feelers, when viewed from the front has the appearance

The Star-Nosed Mole.

of a star, hence the common name "star-nosed." The two cartilaginous fibres situated beneath the nostrils are the shortest. The use of this radiating process has not been fully ascertained, but it is quite probable that it is extremely sensitive, and is used for detecting the presence of its prey. It always touches or feels an object with this "star" before swallowing it.

The star-nose is subterranean in its habits, and rarely quits the ground, at least during the day, and hence it is seldom seen. It is generally found in moist valleys along the banks of streams, and consequently does not damage gardens and lawns by digging furrows through them, like the common mole. Its food consists of earth-worms, and the grubs of beetles, cicadas, and other ground-dwelling insects. In captivity it will eat raw meat of any kind.

During the breeding season the tail of the star-nose becomes greatly enlarged, and this form has been described

* From *Scientific American.*

as a *new* species. Its fore-feet, like all the moles, are very powerful for the size of the animal, and are formed for burrowing in the ground. It makes rapid progress in soft earth, but upon the surface its movements are awkward and slow.

Its nest is large, and composed of withered grasses and leaves, and is mostly situated in an excavation beneath a stump or log. In the very young animals the radiations on the nose are but slightly developed.

Its eyes are small and rudimentary, almost concealed in the fur, and it is extremely doubtful whether they have the power of vision even in the slightest degree. In their dark burrows eyes would be of no use to them; on the contrary, they would be a source of inconvenience, inasmuch as they would continually be irritated by sand and dirt. There is an orifice in place of an external ear, which does not project beyond the skin.

The body is covered with dense soft fur, brownish-black above, a shade lighter beneath. The length of the body of the star-nose is about 5 in., and of the tail 3 in.

C. Few Seiss.

Editorial Gossip.

We are glad to see that our former contributor, Dr. Andrew Wilson, is about to give four popular lectures on Anatomy and Physiology, in Princes' Hall, Piccadilly. The subjects are—The Skeleton; Joints and Muscles; the Heart and its Work; the Nerves, Brain, and their Work. These are subjects in which we all have a very direct personal interest, and treated as in Dr. Wilson's hands they are sure to be, they cannot but be found at once most attractive and most instructive.

In a few weeks a new year, and with it a new volume of Knowledge, will commence. Although we have every reason, from the communications which reach us, to believe that our readers are well pleased with the weekly contents, it seems well at this season to consider whether there is not room for improvement, and also what new subjects may be desirable for the coming year. Without "seeking to proticipate" the work of the whole year, we wish to indicate the following points as forming part of our plans.

First, we propose more rigidly than of yore to exclude all that even approaches religious controversy. In our earlier numbers we promised that everything relating to religious dogma should be excluded; but as regards those thoughts associated with science which bear on what has been called natural religion we expressed no such purpose. Nor indeed do we now. No contributor or correspondent need fear that anything he may write expressing his sense of the mystery which lies at the back of all the truths and all the discoveries of science, will be deleted as unsuited to these columns. But we must exclude all attempts either on the one hand to emphasise such expressions of individual opinion, or on the other hand to make them the subject of controversy. Letters addressed *with either purpose* to the editor will be simply acknowledged as received, but no word of reply will be given them.

Among the subjects for the new year, we may mention that arrangements are in progress for a series of papers on insects by Mr. Butler, a paper from whose pen appears in the present number. We hope to have from the pen of Mr. Grant Allen a series of papers on the flowers of the year. Mr. Slack's interesting papers on microscopic work will be continued, as will those by Mr. W. Mattieu Williams on the "Chemistry of Cookery." Mr. Thomas Foster, whose papers on the "Morality of Happiness" are drawing to a close, has promised a series of short papers on "How to be Happy," by which we understand him to mean, how to be as happy as may be, in what Liebnitz called "this best" (but not perhaps happiest) "of all possible worlds." Mr. Clodd will contribute shortly some papers on Dreams and Dream Philosophy, and later a series on Evolution (already in preparation). The papers on "How to Get Strong," which thus far have dealt rather with general principles than details, will be continued fortnightly during the year, each presenting special exercises adapted for particular classes and for the strengthening or "limbering" of particular muscles. F.R.A.S. (whom some of our correspondents insist on identifying—quite mistakenly—with the editor) has promised to continue fortnightly, besides the "Face of the Sky," his interesting account of work with a 3-inch telescope, taking planets, moon, sun, stars, or nebulæ, *pro re natâ*,—we beg pardon, we should have said, as occasion may arise. Mr. Slingo will give a series of simple and practical papers on electro-plating, which we trust may encourage many to amuse their leisure with very interesting experiments. The Editor proposes to begin and continue fortnightly two series of papers. One of these will be on the Almanac, taking *Whitaker's Almanac* as the special work of reference, and explaining month by month the various statements made in that wonderfully complete almanac, respecting the rising, setting, &c., of the sun and moon, the equation of time, the positions, &c., of the planets, and the phenomena of the skies generally. From a great number of letters which have reached us we believe such papers will be found useful. The other series will relate to mapping, presenting and illustrating the various methods of map projection which are used in treatises on geography, astronomy, &c. We know of no better way of encouraging geometrical tastes, and few better ways of stimulating geographical and astronomical inquiry, than the practice of making maps and charts on various systems of projection. The work is within the capacity of all, it is more interesting than many pursuits specially intended for amusement, and more instructive sometimes than the most profound and abstruse calculations.

In our first two volumes we gave, as systematic astronomical illustrations, the star-maps forming the volume now published as "The Stars in their Seasons"; in the third and fourth volumes have appeared the series entitled "Sun Views of the Earth." The fifth and sixth volumes will present a series of "Zodiacal Maps," on an adequate scale, forming when completed a set showing the entire zodiac to a breadth of about 10 deg. north and 10 deg. south of the ecliptic, each map overlapping its neighbours on either side by several degrees. These maps will show the stars black on a white ground for convenience in marking in the paths and positions of sun, moon, and planets either in 1884 or in any other year.

The papers on Chess and Whist will be continued as before. We have invited Mephisto to resume our original plan of presenting occasional short studies of the leading Chess openings. We continue to regard Whist as well as

Chess as a scientific game, though some correspondents who apparently know little of the game and nothing of its real charms, objurgate us for allowing what they call a mere chance game to be dealt with in these columns. We invite those who so view Whist to study the game which adorns our Whist column this week, and to consider whether an average problem in Mathematics would more effectively test the powers of combination than the problem which was presented to all four players at the close of this remarkable game. Whist is of course, like Chess, to be regarded really as a mental relaxation only, not as a suitable subject for profound time-consuming study; but that it should be so excellent as a recreation yet so actively exercising the mind (as cricket, football, and like good recreations tend to strengthen the body) justifies its recognition here as worthy of a place alongside that prince of scientific home-games, Chess. Yet Whist, unlike Chess, will not appear weekly.

"Our Mathematical Column" we no longer promise to continue *seriatim*, though it will by no means disappear. Should it reappear as a *weekly* feature, it will probably be limited to illustrative problems of interest to students as akin to those which appear in examination papers.

We cannot promise at present such increase in the quantity of matter offered to our readers as can only be safely and steadily provided for when our circulation has attained to a number already definitely decided upon. Some readers have pointed to publications kindred to Knowledge in certain respects, which offer more matter to their readers. We can only reply that if we filled these columns with correspondence, borrowed matter, and matter offered for nothing (and for the appearance of which in type the authors would even be willing to pay), we could safely purvey half as much matter again as weekly appears in our pages. But as matters actually are, the case is otherwise. Among the objects in view when Knowledge was started, the appearance weekly of a certain amount of original matter was not held to be the least important. The Editor may also remind readers that the time devoted to Knowledge by him is not spare time, but time specially withdrawn from other work. It is most pleasant to him, and worth some sacrifice of time and labour, to be brought directly into communication with great numbers of those who have kindred tastes and follow kindred studies. He trusts the pleasure is mutual. But for this as for everything that is worth anything, he has to pay a price; and what he can afford rather than what he would wish to pay has to be considered.

Readers have however shown so kindly and considerate an interest in Knowledge and its progress, that the work cannot but become constantly lighter and more pleasurable. Each who adds one to the number of our readers does his share towards doubling our constituency; and with each such increase comes "the promise and potency" of increased efficiency and value in Knowledge itself.

The Editor desires to state that during the last four weeks he has been prevented from attending to literary work as he could wish, by the return of head pains similar to those which followed the railway accident of July 21st last. These seem now yielding to treatment.

THE FACE OF THE SKY.

From Dec. 7 to Dec. 21.

By F.R.A.S.

FINE individual spots and groups of spots continue to appear upon the Sun's face, which should be examined on every clear day. The aspect of the night sky will be found delineated on Map XII. of "Stars in their Seasons." Mercury is for all practical purposes invisible, his great south declination involving him in the horizontal mist of the winter sky—an observation which applies equally to Venus. Mars does not south until morning, but may be very fairly well seen after ten or eleven p.m. The angular diameter of his disc increases to 13″·4 by the 21st; but he is, of course, under these circumstances, a relatively small object, and requires a powerful telescope to scrutinise him with anything like a satisfactory result. A small one, however, will suffice to show that his disc is still gibbous — *i.e.*, less than a circle. Mars is in the barren part of the sky, to the west of Leo ("The Stars in their Seasons," Map III.). Jupiter is by far the most brilliant object now in the night sky, and is very well placed for the observer, although he still souths after midnight. He is situated to the south-west of the "Præsepe" in Cancer (same map). The phenomena of his Satellites visible before 1 a.m. during the period covered by our notes are as follows:—To-night (7th) Satellite III. will re-appear from occultation at 11h. 58m. p.m., and the shadow of Satellite I. come on to Jupiter's face at 12h. 6m. On the 8th an eclipse of the First Satellite will happen at 9h. 18m. 26s. p.m., the same Satellite reappearing from occultation (of course, after passing behind the body of the planet) at 12h. 32m. On the 9th the shadow of Satellite I. will quit Jupiter's disc at 8h. 54m., followed by the Satellite casting it at 9h. 50m. p.m. On the 10th the ingress of the shadow of Satellite II. will happen at 8h. 25m., Satellite II. itself coming on to the planet's face at 10h. 15m. At 11h. 19m. the shadow will pass off the opposite limb, Satellite II., though, not doing so until between 1 and 2 a.m. on the 11th. There will be an eclipse of Satellite III. on the 14th, at 8h. 36m. 24s. p.m., and one of Satellite I. on the 15th at 11h. 11m. 50s. On the night of the 16th four sequent phenomena will reward the student. At 8h. 28m. the shadow of Satellite I. will enter on to Jupiter's face, followed by the Satellite itself at 9h. 16m. The shadow will leave the planet at 10h. 48m., as will the Satellite at 11h. 36m. On the 17th Satellite I. will reappear from occultation at 8h. 44m.; the ingress of the shadow of Satellite II. will happen at 11 o'clock, and that satellite will begin its own transit 33 minutes after midnight. On the 19th II. will reappear from occultation at 10h. 25m. On the 20th the comparatively rare phenomenon of a transit of Satellite IV. will occur, and should be carefully watched to determine whether the Satellite is invisible while superposed on Jupiter, whether it looks brighter than his belts, &c., or whether it looks dark, like its own shadow. Curious observations of transits of the two outer Satellites are extant, and no opportunity should ever be lost of watching them across Jupiter's disc. Satellite IV. will leave the planet's face at 11h. 5m. p.m., on the 20th. On the 21st, Satellite III. will be eclipsed at 12h. 34m. 48s. p.m. Finally, on the night of the 23rd, the ingress of the shadow of Satellite I. begins at 10h. 22m., the Satellite follows its shadow at 11h. 1m., and the shadow passes off 42 minutes after midnight. Saturn travelling away from ϵ Tauri in a westerly direction ("The Stars in their Seasons," Map I.) continues to be almost as favourably placed as he can be for the observer. There is no sensible change in the opening of his ring-system. Our drawing and description in p. 319 will instruct the student exactly what to look for in this wonderful and interesting system. Uranus is not yet fairly visible; but any one who cares to regard a seeming-dullish 8th mag. star, may fish for Neptune some 3° or 4° south of δ Arietis (Map I. of "The Stars in their Seasons.") Pons' Comet of 1812, to which we have previously referred on pp. 292 and 319, travels during our specified period from the north-eastern part of Lyra across Cygnus, passing over a portion of the Milky Way between the 11th and 21st. The moon's age at noon, to-day, is 7·7 days; and, quite obviously, on the 21st, it will be 21·7 days; so that, up to about the 18th, she will be very well situated for the observer. During the interval covered by these notes, four occultations of stars will happen at convenient hours. The first will be that of the 6th mag. star, B.A.C. 1272, which will disappear at the moon's dark limb at 6h. 10m. p.m. on December 12, at an angle from her vertex of 9°; and will reappear at her bright limb, ·37 minutes later, at an angle of 296° from her vertex. On the afternoon of the 13th, *m* Tauri, a star of the 5½ mag. will disappear at the dark limb, at a vertical angle of 96°; to reappear at the moon's bright limb at 5h. 23m. p.m., at an angle of 200° from her vertex. At 7h. 20m. p.m. on the 15th, λ Geminorum, a 3½ mag. star, will disappear at the moon's bright limb at an angle from her vertex of 37°, reappearing at her

dark limb at 8h. 14m. p.m., at a vertical angle of 236°. Finally, on the night of the 18th, 16 Sextantis, a star of the 6th magnitude, will disappear at the bright limb of the moon, at an angle of 45° from her vertex, at 11h. 6m. It will subsequently reappear at 8 minutes after midnight from behind her dark limb at an angle from her vertex of 204°. At noon to-day the moon crosses the boundary between Aquarius and Pisces, which last-named constellation she does not quit until the same hour on the 10th. She then passes into Aries, her passage across which occupies until 3 a.m. on the 12th, when she enters Taurus. She remains in Taurus until 10 a.m. on the 14th, at which time she moves into the extreme northern part of Orion; this takes her 11 hours to traverse, and she leaves it for Gemini at 9 o'clock the same evening. She occupies until 11 a.m. on the 16th in crossing Gemini, which she then leaves for Cancer. At 2 a.m. on the 18th, she crosses the boundary into Leo, and at 9 p.m. on the same day descends into Sextans, which she takes just 24 hours to traverse, returning to Leo at nine o'clock at night on the 18th. She quits Leo for Virgo at 11 p.m. on the 20th, and is still in Virgo when our notes terminate.

"Let Knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the EDITOR OF KNOWLEDGE; *all Business communications to the* PUBLISHERS, *at the Office, 74, Great Queen-street, W.C.* IF THIS IS NOT ATTENDED TO DELAYS ARISE FOR WHICH THE EDITOR IS NOT RESPONSIBLE.

All Remittances, Cheques, and Post Office Orders should be made payable to MESSRS. WYMAN & SONS.

The Editor is not responsible for the opinions of correspondents.

NO COMMUNICATIONS ARE ANSWERED BY POST, EVEN THOUGH STAMPED AND DIRECTED ENVELOPE BE ENCLOSED.

IS THE SUN GREEN?

[1034]—The double stars present the phenomenon of suns with *complementary* lights. All stars do not appear to shine with white light. May it not, then, be possible that our sun appears green to the eyes of beings in other solar systems than ours? "But if it were green, it would be seen to be green," most persons would exclaim. This, however, is by no means a necessary consequence. My contention is, on the contrary, that *the eye becomes insensitive to the tone of the light by which it is illuminated*; as young artists find to their cost in first attempting to paint by artificial light. Unconscious of the yellowness of their *gas*-sun, they take no account of the altered values of their yellow pigments. Objects reflecting vibrations of the same periodicity as the gas-light will appear white; and so it would be if the artificial source of illumination were of any other hue, say, for instance *green*; in which case, the green tints of the same periodicity as the illuminating source would also appear white,* and so on. This may be illustrated by various experiments. Moreover, I am induced to believe that our sun appears green in planetary systems lighted by stars shining with other coloured lights than our own, from the fact that *green* occupies the *mean* position in the *prismatic* spectrum, and therefore represents the average effect which is produced on eyes outside of our solar system, by the neutralising action of the rays, of opposite periodicities, on each other. The values of the mean elements of any two correspondingly opposite colours, both in Young's and in Herschel's tables of wave lengths, &c., too closely agree in every case, with the numerical values of the central green, to be regarded as a fortuitous coincidence.

In the foregoing remarks I have used the language usually adopted in writing and speaking on the subject of light, although it is very incorrect and very misleading, but it is difficult to do otherwise, without resorting to considerable circumlocution. Nevertheless, according to the undulatory theory—and strictly scientifically speaking—objects, the sun included, only appear to be either luminous or of certain colours. These phenomena of light and colour are really but the affections of sense, appearances produced in us by mechanical vibrations of various wave lengths, &c. They do not inhere, as most people suppose, in the vibrations and the objects themselves. An expedition undertaken in order to discover whether the sun be red, green, or violet would, therefore, if the words were literally interpreted, be simply an absurdity.

W. CAVE THOMAS.

* Whiteness is, in my view, the effect of the neutralised, or average, action upon the retina of any special series of vibrations.

STRANGE COINCIDENCES.—DOUBLING OF CAPITAL, &c.

[1035]—In reference to the motion of the magnetic poles, Sir Snow Harris makes the following observations:—"By a curious coincidence these periods (1740, 860, 4609, 1304 years) involve a number, 432, sacred with the Indians, Babylonians, Greeks, and Egyptians, as being dependent on great combinations of natural events. Thus, the periods 860, 1304, 1740, 4609, become, by a slight modification, 864, 1,296, 1,728, 4,320, which are not inadmissible, considering the complicated nature of the observations from which the first numbers are derived. Now, these numbers are each equal to 432 multiplied by 2, 3, 4, and 10 successively. According to the Brahmin mythology, the world is divided into four periods, the first being 432,000 years, the second 432000×2, the third 432000×3, the fourth 432000×10. It is also, according to Hanstein, not unworthy of remark that the sun's mean distance from the earth is 432 half radii of the sun; the moon's mean distance 432 half radii of the moon; but what is more especially striking is the circumstance "that the number $250920 = 432 \times 60$ is the smallest number, divisible at once by all the four periods, and hence the shortest time in which the four poles can accomplish a cycle. Now, this time coincides exactly with the period in which the precessions of the equinoxes complete their circle—certainly a curious and remarkable series of coincidences."

Problems concerning the doubling of population, capital, &c., may be solved by the following formula, which is, I think, simpler than that furnished by your correspondent "T. J. B." (972):—

$\left(1+\frac{1}{x}\right)^n = 2$. Here x or n may be readily found. The reason for the rule is also very plain; thus: Let a = the number of people or amount of capital and $\frac{a}{x}$ the first year's increment; then $a+\frac{a}{x}$ = number at end of first year.

$$\left(a+\frac{a}{x}+\frac{a+\frac{a}{x}}{x}\right) = a+2\frac{a}{x}+\frac{a}{x^2} = \text{number at end of second year.}$$

$$\left[a+2\frac{a}{x}+\frac{a}{x^2}\right]+\frac{a+2\frac{a}{x}+\frac{a}{x^2}}{x} = \left(a+3\frac{a}{x}+3\frac{a}{x^2}+\frac{a}{x^3}\right) = \text{number at end of third year.}$$

Or generally $a + m\frac{a}{x} + n\frac{a}{x} + p\frac{a}{x^3}$ + &c., m, n, p, &c., being the coefficients of the binominal $\left(1+\frac{1}{x}\right)^n$ = number at end of nth year. We can therefore put $a\left(1+\frac{1}{x}\right)^n = 2a$; or $\left(1+\frac{1}{x}\right)^n = 2$

$$\text{Whence } 1+\frac{1}{x} = \sqrt[n]{2}$$
$$\frac{1}{x} = \sqrt[n]{2}-1$$

Ex.—At what rate must a population increase annually in order to double itself in 100 years?

$$\left(1+\frac{1}{x}\right)^{100} = 2; \text{ or } \frac{1}{x} = \sqrt[100]{2}-1$$
$$\frac{1}{x} = \cdot00695; \quad x = \frac{1}{\cdot00695} = 144$$
$$\text{or } \frac{25}{36} \text{ per cent.}$$

In what number of years will a population, increasing at this rate, double itself?

$$(1+\cdot00695)^n = 2$$
$$n = \frac{\text{Log } 2}{\text{Log } 1\cdot00695} = \frac{30103}{\cdot00300} = 100 \text{ nearly.}$$

R. JONES.

THE SEVERE WEATHER OF THE 13TH–15TH.

[1036]—Probably "H. J. Poole," and "your readers generally," will be interested by the following particulars of observations made on temperature here—one of the stations of the "second order"—at the same time that those published in KNOWLEDGE of last week were made by him in the S.W. of England:—

Night of 12th,	minimum temperature on grass,	25·5	deg.
„ 13th,	„ „	23·0	„
„ „	„ in Stevenson's screen (4 ft. above ground)	28·3	„
Day of 14th,	maximum temperature in screen,	44·0	„
Night „	minimum „ „	30·0	„
„ „	„ on grass,	26·1	„

Temperature of air (dry bulb in screen) at 9 a.m. on 14th, 32·5 deg.

The wind at 9 p.m., 12th, was blowing light airs from S.S.E., and continued so till early morning on the 15th, when it went to the south.

It is very remarkable that the minimum temperature in "H. J. Poole's" screen should, on the night of the 12th, have been 1·5 deg. *below* that registered by the minimum thermometer on grass.

As he remarks, it does not appear that such severe weather is at all normal for this period of the year, especially in this district, which is supposed to be favoured with a tolerably equable and moderate temperature. It is, however, very evident that the late spell of sharp weather, occurring as it did between two periods of moderately warm weather, was pretty universal.

Probably it is not generally known that this short period of severe cold was preceded and followed by a considerable electrical disturbance of the atmosphere, as indicated by the occurrence of very vivid flashes of lightning (without thunder) for several nights. My station is 137 ft. above the sea-level and close to the sea. My instruments are very accurate, having been just examined by the inspector from the Meteorological Office, London.

In concluding, I may say that there has been no fog here this month.—I am, sir, faithfully yours,

Peel, Isle of Man. T. H. DAVIS, F.R. Met. Soc.

TRICYCLES.

[1037]—Having read your paper for some time, and being much interested in the different articles, I see one on the 16th in reference to tricycles, by Mr. Browning, and can readily endorse the advice he gives in reference to leather mud-guards for front-steering tricycles. These are a great boon in winter and wet weather, as it is almost impossible to get the metal guards to thoroughly protect the feet and ankles from being very much splashed; and for ladies they are most requisite. As regards guards for large wheels, this, I think, a more difficult thing. 1st. As to adaptation of fitting. 2nd. Wind resistance. Where machines are made a proper width, there is rarely much trouble, except in windy weather, when the mud is blown from the wheels to rider.

In reference to the brakes, I cannot altogether agree with the writer of your article, where he speaks of tyre brakes being almost extinct. These I have now tried over a period of three years with the greatest comfort, on a Cheylesmore rear-steerer, and as they are at present fitted, have found them perfectly reliable on the steepest hills; in fact, some of my friends touring on the Continent have found them thoroughly efficient even in the ascent of the Alps. Should band brakes be properly constructed, the application of a little chalk will generally be found to answer every purpose, as resin, although making the brake very powerful, often causes a loud, screaming noise, which is most unpleasant, and often frightens horses. A RIDER.

TRUTH STRANGER THAN FICTION.

[1038]—I think the difference in carriage (of charged and uncharged cells) was on account of the supposed danger of cells being full. 17*s.* 6*d.* is not the carriage for returns empty, and I believe that charged batteries travel as dangerous goods.

JOHN ALEX. OLLARD.

LETTERS RECEIVED AND SHORT ANSWERS.

A. N. S. That letter still in hand. Full of interest, but space not yet free.—E. W. WALLIS. Am unable to find space for the multitudes of such announcements sent me.—ADELAIDE PROCTOR. Weakness appeals to strength for pitiful consideration: it shall not plead in vain. For the mental illness of which your letter presents the symptoms, I know, alas, of no remedy. The poetess, deceased, whose name you borrow (but not with sufficient e's) was *not* mathematical: she *was* however a lady.—C. W. VIND. Your suggestion is worth careful consideration. I will convey it to the several writers.—J. HAMER. Thanks. Wish you would state the varied readings.—RHEDARUM ARTIFEX. Know nothing about trustworthiest books on Traction.—D. H. DAVIS. Thanks. Letter in type. But for periodical reports we have no space.—M. F. D. Many comets do circulate constantly round the sun. A comet which passes eventually away from the solar system is one which came originally from space beyond his domain, and had there a velocity independent of that which he can impart as the comet approaches him. The recession results from the acquired velocity and the original velocity of approach combined, the former being gradually parted with as the comet recedes, but the latter remaining.—S. C. WALFORD. That promise was made before a certain railway accident, which much interfered with all my plans.—H. H. Have preferred (hoping you will not object) to send picture to engraver, to do his best with.—C. E. WILLIAMS. Know of no work dealing with the insects mentioned in Shakespeare's plays, nor whether Mr. Patterson's book on the subject is in print.—W. TREGAY. See Editorial Gossip. Would have attended to this matter sooner; but all my literary work has been hampered for several weeks past by the return of head pains such as followed recent railway accident.—G. E. S. WAGNER. The subject of thought-reading is under investigation. For my own part, I see nothing outside the range of scientific inquiry in the matter.—H. CLARKE. It is not for astronomers to change accepted modes of speaking about sunrise and so forth. We should be ridiculed, and very rightly, if in ordinary talk we spoke of "man rising to the heavenly bodies" as you suggest; and we should be no nearer to exactness after all.—H. N. SMITH. Suez Canal matters hardly in our line.—W. H. JONES. Many thanks; but have not space for Magyar Folklore.—P. S. I really do not know why there are so many cats with eyes of different colour.—J. W. My opinion can be of no real value; but I should say the cocoa-nut fibre would be best.—SENEX. You ask me what is the soul. No soul can say. We may call it *animula vagula blandula, hospes comesque corporis*—but that don't help us.—C. Your trisection incorrect, as you will see at once if you apply it to small angles.—C. FEN, THESAUROS, and others. Thanks; but another explanation in type when yours received.—H. MOULTON. That method would do if we could tell the exact moment of partial eclipse beginning. We cannot, however.—W. CAVE THOMAS. I think Prof. Langley has fairly succeeded in showing that the sun is violet; but that is the colour before absorption by his vaporous surroundings. Your letter is in type.—CHAS. RIVINGTON. Thanks for *Shanghai Mercury* with amazing illustration of commatic perversity.—A. M. D. Some think one way some another. *I* think there is much room for improvement in the human race.—F. SHERVILL RUTHIN. Already answered, but thanks.—NOVICE. Alpha Centauri nearest.—J. A. I suppose Huxley to mean all experience, without considering whether such experience can be all collected.—J. REID. The question whether the first day of this century was Jan. 1, 1801, or Jan. 1, 1800, amounts really to the question whether there are 1800 or 1799 years in eighteen centuries. With you I cannot but wonder how such a question came to be "disputed among educated persons."—NAGA PUTNAM. Thanks for extracts, and very pleasant accompanying letter.—R. BARRINGTON. Address not left.—UNCERTAIN. See "Editorial Gossip."—B. POTAMIAN. Thanks. I know nothing, of myself, on the subject. Boys well, now in America. Remember both our interviews perfectly well.—VICTIM TO MISPLACED CONFIDENCE. Have received other such letters, followed shortly by announcement that articles were received, though late. Hope it will be so in your case.—W. L. BROWNE. Regret; but fear no space for series. If separately sent would try to find room. Meantime, will insert the one sent, which is separately valuable.—J. SHORLAND APLIN. All since July 1st.—J. TRELUSE. Unfortunately, such questions lead to gratis advertising.—W. S. BRADLEY. The right ascension of an object is in reality the interval in time between the passage of the first point of Aries (intersection of equator and ecliptic, where sun crosses ecliptic northwards) and the passage of the object across the meridian. Calculation of lunar quarters scarcely suitable subject for short answers.—C. W. B. For life history of paste and vinegar eels see text-books, in which these creatures are dealt with. The mental influence known as mesmerism is undoubtedly a scientific fact, be the explanation what it may. Many have pretended to be so influenced who were not; but idiotic persons of that sort infest all such departments of inquiry.—J. GRAY. All the planets go the same way round; but the satellites of Uranus and Neptune retrograde round their primaries.—F. THOMPSON. I do not want you to believe in any pole, north or south, or European.—A LOVER OF LOGIC. Story amusing; but—perhaps through inexperience you word it as though *we* thought the same of our coincidences—instead of which we specially referred to them as utterly unimportant.—H. J. HARDWICKE. Those matters will be touched on in our Zodiac papers; not suited for short replies.—A. P. T. Lines very apt. Shall appear soon.

Our Whist Column.

By "Five of Clubs."

THE following is the game referred to in our last three numbers. It appeared in the *Field* a few months ago, and was contributed by Mr. N. B. Trist, of New Orleans. The notes and criticisms are by Cavendish; the additional notes by the Whist Editor of the *Australasian*:—

The Hands.

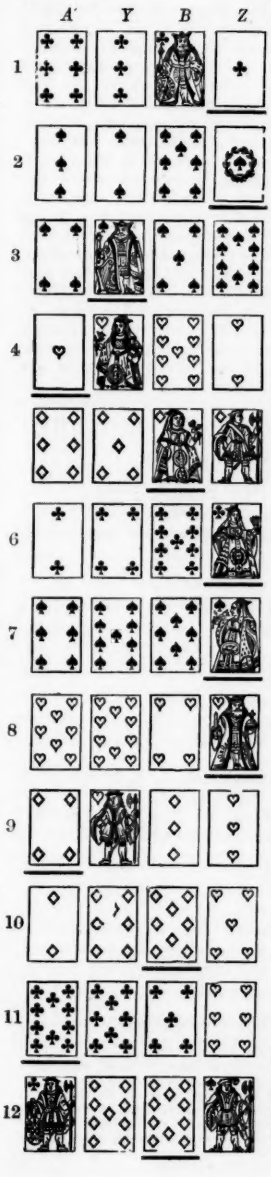
Y.
Diamonds—K, 9, 7, 5.
Clubs—8, 4, 3.
Hearts—Q, Kn, 10.
Spades—K, 9, 2.

B.
Diamonds—A, Q, 10, 8, 3.
Clubs—K, 9, 5.
Hearts—9, 4.
Spades—8, 7, 5.

Y B
Score—
A B, 4. Y Z, 4.
Dealer.
A Z
Trump D. Kn.

A.
Diamonds—6, 4, 2.
Clubs—Kn, 10, 7, 6, 2.
Hearts—A, 8.
Spades—6, 4, 3.

Z.
Diamonds—Kn.
Clubs—A, Q.
Hearts—K, 7, 6, 5, 3, 2.
Spades—A, Q, Kn, 10.



Notes and Criticisms.

Note.—The card underlined wins the trick, and card below leads next round.

Trick 2.—It is a question whether *Z* should not open the Heart suit, but *Z*'s hand is not under examination.

Trick 3.—*B* has called.

Trick 5.—*A* notes that *B* has the Three of trumps. *B* can place all the remaining trumps.

Trick 9.—*Z* ought to lead the Knave of Spades, on which his partner should discard the Eight of Clubs, when *Y* and *Z* win the game. *A* plays a masterly *coup* in trumping with the Four. His argument is as follows:—My partner, with his weak hand, would not have called for trumps unless he had at least five trumps, two honours. All the other trumps are in *Y*'s hand. I know my partner has the Three of trumps, and as it is most probable that he has not Ace and King, or he would have continued trumps at Trick 6 instead of trying to give me the lead again, I shall most likely have to lead twice through *Y* in order to make every trick, which we require to save and win the game. But even then I shall fail if my partner has to lead trumps up to *Y*. I must therefore give my partner an opportunity of playing the *grand coup* with his T[illegible] of trumps if he deems it advisable to do so.

Trick 10.—*B* plays the *grand coup*, undertrumping his partner. If he discards the Club he loses the game. Though *B* plays extremely well, *A*'s *coup* in trumping with the four is entitled to the palm.

Additional Notes.

Trick 6.—*A* believes in the penultimate game. He drops the Two of Clubs to this trick. Therefore there are at least three more Clubs in his hand.

Trick 9.—*Z*, knowing that there are three more Clubs in *A*'s hand, knows also that *A* holds only two more trumps; and if he has noted the card played by *Y* at trick 5, he can infer that both these trumps must be smaller than the Five. It is evident, therefore, that in this illustrative hand *A* derives no

And *A* and *B* win the odd trick.

advantage whatsoever from his use of the penultimate signal in Clubs. All that he does is that at a critical stage of the game he gives his adversary, *Z*, detailed information as to the position of three of the remaining Clubs and two of the smallest trumps; and, so far as we can see, *A*'s public intimation as to these facts leaves *Z* without excuse for his lead of a Heart at the ninth trick, whereby he affords *A* and *B* the opportunity, of which they skilfully avail themselves, of pulling a lost game out of the fire.

But further, *A* has dropped the Eight of Hearts to the eighth trick, *B* the Nine, and *Y* the Ten. Therefore the Knave of Hearts is marked in *Y*'s hand; and both *A* and *B* are void of the suit. Moreover, *B* returned the Nine of his partner's suit at the sixth trick, and hence he cannot have more than one Club remaining in his hand. Consequently, when *Z* leads to the ninth trick, he knows that *B* most probably holds four of the remaining trumps, together with one Club. Therefore he may count *Y*'s hand to consist of the Knave of Hearts, together with three trumps and one Club. If that Club be the winning Club, *Y* and *Z* will win the odd trick whatever *Z* may now lead. The same thing is true if *Y* hold the King and Ten of trumps. But if the winning Club be with *A*, *Z*'s remaining chances of scoring the odd trick are that among his three trumps *Y* holds either the King or the Ten and the Nine. Hence, if *Z* lead the long Spade he gives *Y* the double chance, either of discarding in the event of his holding a losing Club, or, in the event of his holding the command of the Club suit, of overtrumping *A*. In other words, the lead of *Z*'s long Spade places *Y* in the best possible position for winning the odd trick, whilst the lead of the Heart transfers to *A* and *B* the complete control of all the conditions under which they can save and win the game.

Lastly, it needs no proof that at every stage of a game of Whist, and most of all at its most critical stage, the direction of the play ought to be left to the partner who has the greater trump strength. Hence, as the Knave of Hearts may be fairly assumed to be in *Y*'s hand after his lead of the Queen at the fourth trick, it is evident that *Z* ought to have led a small Heart rather than his King of Hearts at the eighth trick.

Society for Psychical Research.—A general meeting of this society was held at 11, Chandos-street, Cavendish-square, on the afternoon of November 22nd. The President, Professor Henry Sedgwick, opened the proceedings with a few remarks, in which he emphasised the importance of extending the area of experiments on thought-transference, in order to multiply the number of persons of unblemished character which those who deny the genuineness of the phenomena must logically conclude to be "in the trick." Mr. F. W. H. Myers then congratulated the society on the extension which had actually taken place, and which had shown the faculties involved in thought-transference to be much commoner than had been at first supposed, and he described in detail a series of experiments made by himself and Mr. E. Gurney, in conjunction with Mr. Malcolm Guthrie, J.P., of Liverpool, on the communication of tastes. These trials had the advantage that the knowledge of the impression to be communicated was confined to those three gentlemen, and the hypothesis of collusion by a code of signals was thus excluded. The experimenters used a great variety of substances, and in a large majority of cases the substance which one or other of them had in his mouth was correctly named or described by the "subjects." Mr. Guthrie followed with an interesting account of the manner in which the experiments with these particular "subjects" had originated; and he exhibited a large number of diagrams, which they had been enabled accurately to represent by a transference of the impression of the original from the mind or brain of the experimenter without spoken words or contact of any sort. Many of these results had been obtained by Mr. Guthrie himself, others by some member of the investigating committee of the Society for Psychical Research, when experimenting alone with one of the "subjects," information by collusion being thus as effectually precluded as information through the ordinary sensory channels. Professor Balfour Stewart then pointed out how illogical is the rejection of these facts as contradictory of known biological laws, they being clearly only an extension of science, such as has been again and again exemplified in its other branches. Finally, Professor Barrett described some trials which showed the extraordinary degree to which muscle-reading could be carried, and also recounted a long series of very careful experiments strikingly exhibiting the power which a mesmerist can sometimes exercise over a "subject" by silent willing. Other papers were deferred for want of time.

XUM

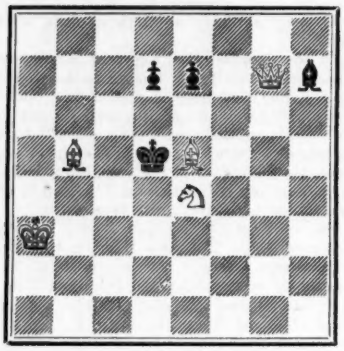
Our Chess Column.

By Mephisto.

PROBLEM No. 109.

By C. Planck.

Black.



White.

White to play and mate in three moves.

SOLUTIONS.

Pearson's Problem, p. 235.

No. 33.		No. 49.	
1. Q to R8	Kt tks Q (best)	1. Kt to R3	B to Kt2
2. Kt to B6	Anything	2. Q to Kt5	Anything
3. Mates accordingly.		3. Mates acc. with Q or Kt.	

No. 105.		No. 106.	
1. Q to K8	Kt tks Q (best)	1. Q to KKt2	P to QB5 (best)
2. P tks Kt (Kt)	Any	2. Kt tks KP (ch)	Any
3. Kt to Q6 mate.		3. Q mates accordingly.	

No. 107 (a Black P on KKt2).

1. K takes B	K to K3 (ch), or	1.	K to Q5 (ch)
2. B to B5 mate		2. R to B5 mate.	

If Kt moves Q takes R mate.

Note.—Problem No. 108 has, unfortunately, a double solution.

There will shortly be published a highly interesting collection of End games, by Herr B. Horwitz, the renowned collaborator of the book by Kling and Horwitz. We understand that besides the old specimens, there will be a valuable collection of newly composed positions published. As at the present time there does not exist another book on endings, we look forward to the publication of this book to supply a long felt want.

FIRST NOTICE.

Games Played in the London International Chess Tournament, 1883.*

We have much pleasure in informing our readers that the book of the tournament has been published. The book is edited by Mr. J. I. Minckin, and its appearance within five months of the tournament bears testimony to the energetic industry of its Editor. Zukertort, Steinitz, Mason, and Bird have annotated their own games, while the largest portion of the games by other players have been furnished with notes by the Editor and Bird. Mr. Wayte has likewise assisted in annotating Tchigorin's games.

We regret to miss Blackburne amongst the commentators. Besides 242 games of the major tournament, the book also contains a selection of 54 games played in the minor tournament. There is also an introduction, giving a complete history of the tournament, together with subscription lists, balance-sheets, speeches, eulogisms, rules, &c. The book contains 371 pages, and is very handsomely got up and printed in bold type. It contains the most valuable collection of games played in modern times. Only a limited number having been printed, we would advise our readers to make an early purchase.

* London: Jas. Wade, 18, Tavistock-street.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

Ralph Appleton.—Best thanks for games, which are welcome.

George Loxdale.—Solution incorrect.

Henry Bristow.—Problem received with thanks. All four solutions correct.

John.—If 1. P to B6, then Kt to R3, followed by the R checking.

G. Gouge.—After 3. Q to QKt4, K takes P without being mate.

Rev. W. Andersson, W., Berrow, A. S. Orr, Donna, R. T.—Solution of Problem 108 by 1. Kt to KB5, is unfortunately correct, but it is not the author's intended solution.

Correct Solution Received.—No. 49: Berrow, Clarence, H. A. N. No. 33: Clarence. Nos. 106 and 107: Ch. H. W., Hammich, T. B. S., R. T. No. 108: Clarence.

Safety in the House.—At a meeting of the National Health Society this week a communication was received from Mr. George Shaw, Master of the Plumbers' Company, in response to a communication which had been addressed to him from the society, expressing the desire to co-operate with the Guild of Plumbers in promoting the systematic instruction, examination, and registration of plumbers. The Master of the Plumbers' Company intimates that the attention of the Guild is directed to this subject, and that methods of forwarding the desired object were under consideration, in which they would be glad of the co-operation of the National Health Society. In the previous year the National Health Society had instituted a series of lectures to plumbers, which were attended by audiences so large that the course had to be repeated, and a subsequent examination was held, which included the testing of practical work done by plumbers. This was conducted by Mr. George Shaw and Mr Ernest Turner. The results showed that, while, on the one hand, plumbers were evidently very desirous of better instruction, on the other hand their work was, in a great majority of instances, so defective, even among the picked men who appeared for examination, that only a small proportion of the prizes could be awarded, and very little of the work was of first-rate quality. Mr. Ernest Hart, the chairman of the National Health Society, read a paper at Liverpool on the subject, and will, in the course of the season, make a communication at the British Institute of Architects, with the view of securing the co-operation of that society; also in the much-needed measure of sanitary reform.

MR. R. A. PROCTOR'S COURSE OF LECTURES.

1. LIFE OF WORLDS.
2. THE SUN.
3. THE MOON.
4. THE PLANETS.
5. COMETS.
6. THE STAR DEPTHS.

See Advt. Pages for full Syllabus.

The following arrangements are complete: the numbers in brackets referring to above list.

ALTRINCHAM, Dec. 10 (3).
WOLVERHAMPTON, 11.
READING, Dec. 12, 14, 19 (1, 2, 3).
DORCHESTER, Dec. 18 (2).
1884.
ROCHESTER, Jan. 21, 23, 25 (1, 2, 3).
GRAVESEND, Jan. 22, 24 (1, 2).
PERRY BAR, Jan. 29 (6).
KING'S HEATH, Jan. 30 (1).
BRISTOL (Colston Hall), Feb. 18, 22, 25, 28; March 3, 6 (the full course).
CHELTENHAM (Assembly Rooms), Feb. 5, 8, 12, 15 (1, 2, 4, 6). At 3 o'clock, Feb. 5 and 12 (3, 5).
BATH (Assembly Rooms). Four Morning Lectures at 3 o'clock, Feb. 6, 9, 13, 16 (1, 3, 4, 6); two Evening, Feb. 6, 13 (2, 5).
BIRKENHEAD, March 10.
ALTRINCHAM, March 11 (5).
CHESTER, March 12, 13 (1, 2).

Note.—*All communications respecting Lectures should be addressed to Mr. John Stuart, Royal Concert Hall, St. Leonards.*

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